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## AMERICAN CONTRIBUTIONS TO ANTHROPOLOGY<sup>1</sup>

By DR. ROBERT H. LOWIE

UNIVERSITY OF CALIFORNIA, BERKELEY

AMERICAN anthropology has been in large measure shaped by its opportunities, which implied duties. The New World presented an apparently distinct variety of the human species with great physical, linguistic and ecological diversity. After their discovery these indigenes were threatened at times with extinction or miscegenation, everywhere with a possible obliteration of their mode of life. The obvious task was "to save vanishing data." As a result sheer collection or description bulks large in American anthropology. One thinks of the impressive series of annual reports and bulletins issued since 1879 by the Bureau of American Ethnology; the vast collections of crania and skeletons amassed by the late Dr. A. Hrdlicka in the U. S. National Museum; the intensive reports on Californian tribes due to A. L. Kroeber and his disciples.

<sup>1</sup> Address of the retiring vice-president and chairman of the Section on Anthropology, American Association for the Advancement of Science, Cleveland, September, 1944.

Of course, Americans have not shied away from other areas on principle. Honolulu, with its Bishop Museum, has been a natural spring-board for Oceanian investigations, and other institutions have now and then financed transoceanic research. A. B. Lewis, Margaret Mead, Hortense Powdermaker have studied Papuans and Melanesians; Martha Beckwith, H. L. Shapiro, E. W. Gifford, Ralph Linton are associated with various Polynesian projects; Wm. Lloyd Warner and D. S. Davidson have, respectively, investigated Australian sociology and technology; Raymond Kennedy, E. M. Loeb, Cora DuBois are specializing in Indonesia; and George Herzog, Melville J. Herskovits, Wm. R. Bascom are reckoned Africanists. However, in the nature of the case most of us have remained predominantly Americanists.

Our saturation with the concrete data of the New World has given a distinct flavor to American work during the last half century. To outsiders we have

often appeared, plausibly enough, as intelligent—and not always over-intelligent—collectors of raw data. In requital we have tended to look with the empiricist's scorn upon European theories as the lucubrations of closet anthropologists. Probably most of us would concede nowadays that both attitudes are one-sided.

In my remarks to-day I shall endeavor to sketch the nature of American work in the main branches of our science, though it is obviously only on a small segment of anthropology that I can speak with anything like authority.

#### PHYSICAL ANTHROPOLOGY

On this subject more particularly I speak as an interested spectator rather than as in any sense an expert. Our compatriots seem to me to have contributed in three diverse ways. On the one hand, they have described our aborigines, fixing their status within the human species. Secondly, but for obvious reasons less frequently, they have examined other races and synthesized relevant findings. Finally, they have grappled with problems of what may broadly be termed "human biology."

Samuel G. Morton (1799-1851), who has been called the first physical anthropologist of America, collected 968 Indian skulls, on whose study rests his amply illustrated work, "Crania Americana" (1839). He postulated the unity of all American Indians, including the Mound Builders, but gave to the Eskimo a distinct position. From dearth of Asiatic material he failed to see the connection between the American natives and the Old World Mongoloids, but later investigators—to mention only Hrdlicka and Boas—amply demonstrated the derivation of our Indians from eastern Asia. Of subsequent treatises I need mention only Dr. Bruno Oetteking's "Craniology of the North Pacific Coast" with its "splendid mastery of anthropometric technique" and "technical perfection."<sup>2</sup>

Under the second head we may note that as early as 1844 Morton had extended his survey to the ancient Egyptians, whom along with their neighbors and descendants he rightly classified as Caucasian. In later periods the desire to place the American race within the species automatically led to comparison with Asiatic types, as already suggested in my reference to Boas and Hrdlicka. Roland B. Dixon's "The Racial History of Man" (1923), however liable to criticism in its basic assumptions, had the unquestionable merit of envisaging humanity as a whole. The more restricted, yet sufficiently comprehensive synthesis of Wm. Z. Ripley, "The Races of Europe"

<sup>2</sup> See E. A. Hooton, in *American Anthropologist*, 33: 444f., 1931.

(1899), and its more recent namesake by C. S. Coon (1939) naturally come to mind as dispelling the charge of provincialism. Nor should we forget Coon's field work in Albania and Arabia; E. A. Hooton's monograph on "The Ancient Inhabitants of the Canary Islands" (1925); and H. L. Shapiro's investigations in Polynesia.

Falling simultaneously under the head of research in extra-American physical anthropology and in human biology may be reckoned studies that bear on evolutionary problems. Jeffries Wyman is credited with the first accurate osteological description of the gorilla (1860), and in recent years Adolph H. Schultz has gained eminence by his studies of primate ontogeny. Naturally all writers on human evolution are bound to grapple with the interpretation of fossil finds, but my colleague, Dr. Theodore D. McCown, himself unearthed a series of finds in Palestine which shed light on basic evolutionary processes.

In a third category I should place investigations bearing on such fundamental phenomena as growth and heredity. Since Henry P. Bowditch's pioneer efforts (1877) a considerable number of American students have concentrated on the factors of growth, including such environmental conditions as economic status. (For bibliography, see Franz Boas, "Race, Language and Culture," 1940, pp. 49-52.) Boas was especially concerned with the correlation of descriptively diverse physiological phenomena—such as that between early menstruation and early eruption of the molar teeth.

As to problems of heredity, Boas's paper on "The Half-Blood Indian"<sup>3</sup> in a sense paralleled Von Luschan's observations on segregation in Asia Minor and, of course, considerably antedated the rediscovery of Mendelism. Boas's much misunderstood "Changes in Bodily Form of Descendants of Immigrants" (1912) should be regarded as a study of modifications rather than as an attack on current views concerning the germ-plasm. H. L. Shapiro's "Migration and Environment" (1939) is devoted to a similar theme, culminating in the proposition that "man emerges as a dynamic organism which under certain circumstances is capable of very substantial changes within a single generation."

Speaking under correction, I register my impression that, over and above the obvious descriptive tasks, our physical anthropologists have shed light on significant biological problems related to man.

#### PREHISTORY

Though our archeologists as a group may seem especially liable to the charge of narrowness, we should not forget the veteran George Grant McCurdy's

<sup>3</sup> *Popular Science Monthly*, October, 1894.

persistent interest in Old World prehistory, culminating in his fine two-volume work on "Human Origins" (1924), nor N. C. Nelson's research in Mongolia and Th. D. McCown's in Palestine.

Archeological provincialism is easily understood: exacting preliminary work and sound local interpretation had to precede syntheses of wider import. As knowledge grew, basic chronological questions came to the fore. What was the actual sequence of events in the various major regions of the New World? Could the more ancient finds be considered synchronous with corresponding European specimens? When did man first set foot on American soil? In part such questions affect a general view of human culture history, so that quite naturally European scholars have shared our concern with the results.

For a long time Wm. H. Holmes (1846-1933) loomed as the grand old man among American archeologists. He rendered excellent service in dispelling the fantasies of amateurs and over-enthusiastic professionals prone to correlate crude samples of stonework in this country with the transatlantic Chellean. Holmes's studies "demonstrated that all these chipped stones labelled Paleoliths were only the rejects of the native implement makers thrown away on the workshops because of flaws in the stone or shapes not suitable for making finished implements."<sup>4</sup> Though opinions are still divided as to whether man reached America in the Pleistocene, Holmes's insistence on geological evidence for great antiquity was a healthy corrective to earlier speculation, and probably no reputable investigator would nowadays suggest that American man was contemporary with the Chellean or Acheulean of Europe.<sup>5</sup>

In apparent refutation of Holmes's skepticism, cases of Pleistocene fauna associated with artifacts have been established, but the query remains whether individuals of Pleistocene species can not survive long into the Recent period. On the other hand, in Patagonia Junius Bird<sup>6</sup> has not merely demonstrated tools alongside of skeletal remains of extinct sloths and horses, but also indicated an antiquity of from 3,000 to 5,400 years on geological grounds. Since Indians could hardly have traversed the distance between Bering Strait and Tierra del Fuego, with its variation of geographical zones, in the twinkling of an eye, a respectable historical antiquity for human occupancy of America seems vindicated. Precisely how to assess the time span required is still a matter for debate. Various students have grappled with the problems bound up with the Folsom finds; and F. H. H. Rob-

<sup>4</sup> Walter Hough, in *American Anthropology*, 35: 753, 1933.

<sup>5</sup> Holmes, "Handbook of Aboriginal American Antiquities," I. Washington, 1919.

<sup>6</sup> *Geographical Review*, 28: 250-275, 1938.

erts, Jr., has periodically summarized the archeological, paleontological and climatological evidence bearing on the antiquity of man in the New World.<sup>7</sup>

If I understand the course of development, our prehistorians have made great strides in the matter of technique during the last generation or so. Whereas much of the earlier work was dictated by esthetic motives, A. V. Kidder and N. C. Nelson ushered in the severely stratigraphical approach typical of geology in their investigations of the Southwest; and H. B. Collins, Jr., has similarly investigated the sequence of Eskimo cultures. In the Plains Wm. D. Strong has demonstrated the value of combining a stratigraphic technique with a historical approach, applying the sound principle of working from the known backward to the unknown.

As for the higher civilizations, their study has profited both from the perfection of technique and the widening of horizons. "The Maya and their Neighbors" (1940), the Festschrift in honor of A. M. Tozzer, indicates that the disciples and collaborators stimulated by him have progressed to a pan-American conception of Central American prehistory; and Wm. D. Strong's recent survey of Andean research suggests that our Peruvianists, too, view their problems in hemispherical terms.<sup>8</sup>

#### LINGUISTICS

The amazing diversity of speech in the Western Hemisphere offered a rich field for exploration. Accordingly, scholars soon began to describe and classify native languages. Albert Gallatin (1761-1849), diplomat, Secretary of the Treasury and founder of the American Ethnological Society (1842), was a noteworthy pioneer. Subsequently John W. Powell (1834-1902) published the classification (1891) that was to remain the starting-point of all later efforts.

Thanks to Boas's influence, many workers primarily concerned with ethnography were trained to record native texts, the result being a vast mass of material for philological analysis. Naturally, they were not always up to the standards nowadays exacted by the professional linguist, but Boas also lured into our fold such Indo-Europeanists as Edward Sapir and Truman Michelson, and established a *rappoport* with other specialists in language, such as Leonard Bloomfield. In consequence, we can now claim a fair number of "anthropological linguists"—men who have undergone the severe discipline of traditional comparative language training, but who work mainly or largely with aboriginal tongues.

Consummate craftsmanship, linked with an anthro-

<sup>7</sup> E.g., "Evidence for a Paleo-Indian in the New World," *Acta Americana*, 1: 171-201, 1943.

<sup>8</sup> "Cross Sections of New World Prehistory," 1943.

pological perspective, has yielded excellent results, which are by no means limited to the Americanists' domain. Boas himself passed far beyond its bounds, Sapir constructively grappled with African and Asiatic stocks, and Emeneau's field research was devoted to the Dravidian family.

On the whole, our linguists have manifested greater audacity than is commonly associated with American anthropologists. Dixon, Kroeber and Sapir all attempted to supersede the conservative Powell classification. Sapir adumbrated possible connections between North and Central American stocks, even between Canadian and East Asiatic languages—not to mention his ambitious (though in my humble opinion sterile) global classification of speech into four types.

In the matter of genetic relations Powell and Boas were conservatives, but this does not mean that they lacked interpretative aspirations. They were merely concerned with other questions, such as the processes of mutation and the psychology of speech. Boas, more particularly, intent on seeing each language in the light of its distinctive genius, was forever defining the categories of thought which each of them reflected.

By and large, our linguists have probably been more conspicuous in displaying a fruitful combination of empirical knowledge, technical expertness, breadth of view and insight than any other group of American anthropologists.

#### CULTURAL ANTHROPOLOGY

The history of cultural anthropology in the United States presents several main phases. Among these the period of fantastic theories can not be ignored, for they were broached by reputable writers. Catlin cited bull-boats as evidence of a Welsh colony on the upper Missouri, and others pointed to menstrual taboos to prove the descent of our Indians from the Ten Lost Tribes of Israel. Subsequent restraint in historical hypotheses may in part be explained as a justifiable revulsion against such weird fancies.

In quite a different category, of course, belong the schemes of unilinear development of which Lewis H. Morgan's "Ancient Society" (1877) is the outstanding example. Grandiose in comprehensiveness, it rested in part on scientific facts and has been aptly compared to the biological theories of phylogeny that blossomed forth soon after the appearance of "The Origin of Species." As field work in particular regions failed to support Morgan's generalizations, Americanists rebelled against the system and rejected it on principle—much as the experimental biologists and geneticists spurned Haeckel's phylogenetic speculations. Sometimes—as in the case of the Crow clan

organization—they even doubted Morgan's findings where later research established their correctness.

What followed was, for one thing, the type of intensive regional surveys linked with the names of, say, Boas, Wissler, Kroeber, Swanton. It is clear that in the nature of the case the resulting historical reconstructions could not vie in impressiveness with Morgan's laws of social evolution. Any one who eraved shorthand formulae for cultural sequences was bound to view even the bolder efforts of later times as pedestrian alongside of "Ancient Society." In much the same way a fervid Haeckelian would not be content with the contempt for genealogical tables displayed by Jacques Loeb and Thomas Hunt Morgan. Yet it would be preposterous to deny that these scientists were pathfinders as well as critics and that their positive work is the more significant. The Boasian phase of our science should be regarded in similar fashion. Its contribution—which can not, of course, be attributed solely to my revered teacher—lay in a quite different direction from that of the unilinear evolutionists, but that does not mean that its champions were inferior in originality and mental grasp.

Two concrete examples may illustrate my meaning. When Boas began the study of primitive art, the regnant theory of decorative designs, typically championed by H. Stolpe, conceived all such motifs as conventionalized representations of living beings. Boas's refutal of the universal validity of the explanation doubtless struck some ethnologists as an example of his negativism. He had eliminated a view that, admitting all reservations, had accounted for a good deal and had failed to put anything in its place. To me this is as though a zoologist blamed Thomas Hunt Morgan for not supplying an *Ersatz* for Haeckel's phylogenetic scheme. As T. H. Morgan's work on heredity was in a distinct and new direction, so Boas's contribution was incommensurable with that of his predecessors. He demonstrated that savages read meaning into meaningless patterns, that the primitive artist, too, copes with an esthetic tradition, that the urges of a virtuoso may lead to artistic results. He disappoints the seeker of a formula for sequences, but inspires those capable of enjoying new vistas.

For my second illustration I will choose Kroeber's paper on "Classificatory Systems of Relationship."<sup>9</sup> Challenging Lewis H. Morgan, it comes close to denying any correlation between kinship terminologies and sociological usages. I dissent strongly from part of the argument, and Kroeber himself no longer holds his views of thirty-five years ago in unmodified form. But the merit of the paper does not lie in its critique of Morgan; it lies in shifting consideration

<sup>9</sup> *Jour. Royal Anthropol. Inst.*, 39: 77-84, 1909.

to aspects of nomenclature which neither Morgan nor his followers took into account and in suggesting a mode of approach that, although tentative in its concrete form, has proved exceedingly helpful in subsequent research.

To think of the Boasian phase, then, in terms of pedantic soundness devoid of inspiration is radically wrong-headed.

The new insights spring in the main directly from wider and deeper knowledge of fact. In this respect we in the United States enjoyed singular good fortune. It was far easier to go from New York to Montana than from Cambridge University to the Torres Straits, or from Berlin to the Matto Grosso. For us it was possible to return again and again to particular tribes, checking and rechecking results, sometimes having them reexamined by a new investigator. Not only did museum specimens readily accumulate, but aboriginal craftsmen were still extant to illustrate their manufacture. The language handicap proved less onerous for us because some Indians had already learned to speak English; in a few instances they were academically, and could be anthropologically, trained. The inwardness of native life could thus be interpreted for us authentically by "marginal men," of whom William Jones remains a shining example. Even where that was not possible, the conditions of intercourse with natives facilitated intimacy of contact. The respectably long series of biographical sketches ushered in by "The Autobiography of a Winnebago Indian" (1920), edited by Paul Radin, may be cited as the sort of material obtained.

Not that such documents surpassed in authenticity Knud Rasmussen's books on the Eskimo or the reminiscences of the Lapp, Johan Turi. But because of our favorable situation they became more abundant in the United States than elsewhere. In this connection we may recall Malinowski's clarion call in "Argonauts of the Western Pacific" (1922), summoning anthropologists to study "the realities of human life," "the imponderabilia of actual life." More so, his demeanor was that of a prophet preaching in the wilderness, but a reader of Rivers's "The Todas" will understand why the manifesto struck a responsive chord in Britain. Now, in the very same year appeared a symposium on "American Indian Life," and in her editorial preface Elsie Clews Parsons expressed the credo of her twenty-odd collaborators in much the same terms as Malinowski. Through our good fortune, learning about the true inwardness of native thought was no longer with us the goal of a solitary messiah, but the aspiration of the rank and file.

This statement is made in anything but a spirit of jingoistic braggadocio. For one thing, there is a gap

between aspiration and fruition. As a matter of fact, I am extremely ambivalent about the later developments of the phase I am describing. Thanks to our opportunities and the organization of anthropological training, we have collected a vast body of sound information, perfected techniques, and produced many competent craftsmen. Unfortunately, however, the last decades also coincide with a deterioration of general education in the United States that elsewhere would hardly be believed. In consequence, we have graduating seniors who do not know the meaning of common words, and Ph.D.'s who write in a style unworthy of a high-school pupil. I can not wax ecstatic over science that is practised as a trade. Mere competence in the handling of field techniques may make a good ethnographic craftsman, but not a good cultural anthropologist.

There is still another, a contemporary, phase to be noticed. A goodly number of our younger colleagues concern themselves primarily with personality in its relations to culture, which they approach by a fusion of ethnographical with either psychoanalytic or sociological outlooks. My reaction to these movements is not at all negativistic. When "youth is knocking at the gate," I am not, indeed, prepared to follow Hilda Wangel's advice in Ibsen's "The Master Builder" and throw the door wide open, but on the other hand I have no wish to slam it in their faces.

As for the psychoanalytic approach, an obvious merit lies in its stressing aspects of native life that had hitherto received inadequate recognition. This is not a slur on the often admirable observations of previous investigators. But precisely as Professor L. M. O'Neale, being both an anthropologist and an expert on textiles, sees significance in fabrics that eludes the ordinary ethnographer, so a clinically trained colleague is bound to note much that would otherwise remain unrecorded or misunderstood. From this point of view Gregory Bateson and Margaret Mead's "Balinese Character; a Photographic Analysis" (1942) must be heartily welcomed. What disturbs me is the conceptual framework within which they and others in comparable studies present their material. I can not gauge how far the authors reflect the generally recognized findings of modern psychiatry, how far merely the shibboleths of an enthusiastic sect whose creed may some time rank as sound doctrine, but can not yet be regarded as established. Not in a spirit of captiousness, but as a layman seeking enlightenment I should like to know, for instance, whether it is orthodox psychology to believe that "fear of many sorts becomes a pleasant emotion . . ." (op. cit., 147). Again, I can not without further instruction understand how any amount of watching could demonstrate a sex difference stressed by the same writ-

ers (p. 24, f.) : What manner of sense impressions can convey the legitimate inference that a man handles a fighting-cock "as an extension of his own body," whereas a woman handles her child "as something separate"? I deny nothing, but I want Adolf Meyer, Thorndike, Woodworth, Nolan D. C. Lewis, *et al.*, in short, any fair cross-section of scientists concerned with mental phenomena, to assess such statements for me.

To make myself clear, the new approach seems to me full of possibilities. Obviously it can aid in the understanding of motor habits, methods of teaching, trance and visionary conditions, shamanistic personalities—all subjects as important for us as they are to a psychologist pure and simple. But before assimilating pertinent findings I should like to be sure of their validity. The late paleontologist, W. D. Matthew, once told me that he would like to write a treatise on land-bridges in which he would indicate where they must be assumed; where they can be inferred with probability; where they are possible; and where there is no ground whatsoever for postulating them. It is such nicety of discrimination that for my guidance I should like to find among our psycho-ethnographers. In my judgment they have something to give me; I want to know, how much.

To turn to the writers who combine sociological with ethnographic techniques and points of view, they are presumably best represented in modern acculturation research. On this subject, as one who has both witnessed and in his own person experienced acculturation, I speak with greater confidence. What impresses me is that I have derived the maximum illumination in this field not from anything produced by our guild, but from W. I. Thomas and Fl. Znaniecki's "The Polish Peasant in Europe and America" (1918-1921); from the second volume of Theodore C. Blegen's "Norwegian Migration to America" (1940); from Theodore Jorgenson and Nora O. Solum's biography of "Ole Edvart Rölvaaag" (1939); and from the correspondence of Friedrich Kapp (in Wilhelm Bolin, "Ludwig Feuerbach" 1891). The reason seems to me clear. The study of acculturation along customary lines usually relates to the impact of our civilization on a comparatively unknown culture. With some distinguished exceptions—I can off-hand recall only Hilde Thurnwald's "Menschen der Südsee" (1937)—even our better monographs fail to delineate varieties of personality in relation to new conditions; and at best the documentation is meager, stimulating rather than quenching our thirst for information. How many Kwakiutl or Omaha Indians do we know as human beings after reading thousands of pages about these tribes?

Obviously the case is quite different for a study of acculturation in higher civilizations, where abundant evidence is either ready for use or can be secured without insuperable difficulty. I therefore venture to suggest that our specialists in acculturation examine the vast material of this order that awaits exploitation from an anthropological point of view.

As I see it, there has been in the past some danger of narrowing the field of inquiry, although the "Symposium on Acculturation"<sup>10</sup> indicates that broader points of view are maturing. Dr. Mandelbaum's discovery of tribes in India living in conditions externally ideal for exchange of customs, yet such as to inhibit cultural osmosis strikes me as highly suggestive. Again, Dr. Ethel John Lindgren's paper, "An Example of Culture Contact without Conflict" (*ibid.*, 40: 605-21, 1938) shows that where Caucasians are not numerically preponderant nor over-sophisticated the relations with an aboriginal people may develop in an exceptionally genial way. We shall get at the core of the matter only after having before us a great many different samples of contact metamorphosis, otherwise there is danger of mistaking special instances—say, of technologically simple and hopelessly outnumbered populations confronted by Western civilization—as typical. I venture to point out a few themes that in my judgment have not yet been adequately considered by anthropologists.

In the first place, I should like to see a synthesis of what is known about the Islamization of various peoples. The suggestive bits in Reuben Levy's "An Introduction to the Sociology of Islam" (2 vols., 1931, 1933) merely whet my appetite. Secondly, some reading prompted by the study of Japanese evacuation undertaken by my colleague, Professor Dorothy S. Thomas, convinces me that the conventional picture of what happened in Japan between 1853 and, say, 1894 is thoroughly distorted. Specifically, there was no initial wholesale repudiation of Western values. At some opportune time I should like some one conversant with the language to revise current opinion by examining the periodical literature of the crucial decades. Third, Americanization requires more intensive study than has been accorded it. It can not, e.g., be viewed in terms of "inferior" immigrants who either crave absorption in the "superior" Anglo-Saxon tradition or perversely resist assimilation from motives of self-interest. Many of the newcomers look with scorn upon the American scene, which they regard as unequivocally "low-brow" compared to what they have known at home. Others, like Rölvaaag, nostalgically try to salvage the values of the homeland and thereby to enrich their adoptive country.

<sup>10</sup> *American Anthropologist*, 43: 1-61, 1941.

To take the illiterate peasants as the norm can only distort our total picture of what is involved, for even though numerically preponderant these immigrants are swayed by their leaders. Finally, there is the generic problem, in Europe not less than in America, of a rural population adapting itself to an urban culture. I agree with Messrs. Conrad M. Arensberg and Solon T. Kimball<sup>11</sup> that such problems can not be solved in purely economic terms. But what is it, apart from economic motives, that drives individuals from the security of a cozy familial, communal, rural existence into domestic service in the towns, and from domestic service into factories? "Back to the land"

has more than once been a rousing slogan; why does its effectiveness peter out?

#### CONCLUSION

In conclusion, I should like to repeat that we in America have been fortunate in our past opportunities. The probabilities are that we shall not be less so in the future. Disturbing as our "ethnic minorities" potentially are to our body politic, they offer rewarding and as yet inadequately utilized fields for research. Further, the World War is expanding our interests. As our archeologists have already turned pan-Americans, let us cease being Americanists and turn global anthropologists.

## SCIENTIFIC EVENTS

### THE ALTON OCHSNER MEDICAL FOUNDATION

THE Alton Ochsner Medical Foundation in New Orleans is a non-profit corporation chartered under the laws of the State of Louisiana for the following general purposes:

1. To conduct research in the causes, prevention and treatment of disease.
2. To provide fellowships whereby selected young physicians who have completed their internships may be trained in the various special branches of medicine and surgery.
3. To provide instruction for practicing physicians and surgeons.
4. To provide diagnostic facilities and hospital care for selected indigent patients.

The charter under which the foundation operates provides that no part of its net earnings shall inure to the benefit of any private individual, but that those earnings shall be devoted exclusively to the advancement of medical science, and to educational, charitable and literary purposes.

The foundation maintains paid fellowships for young physicians who have had at least one year of hospital training in order to enable them to continue their studies and research. These men are accepted for training in various medical and surgical specialties for periods of from one to three years.

Another purpose of the foundation is to conduct laboratory and clinical research into the causes, prevention and treatment of disease. Facilities in this direction have been enlarged considerably through the recent organization of laboratories for chemical research. The new laboratories provide means for close cooperation between clinicians and chemists on questions of mutual interest. It is expected that a frank and mutual exchange of ideas between members of the

two professions will stimulate joint investigative work on diagnostic and therapeutic problems.

The research activities of the chemical laboratories will be concerned especially with the therapeutic aspects of medical enzymology. By this is meant work dealing with the role of extracellular and intracellular enzymes in disease and with disturbances in physiological mechanisms linked to abnormalities in enzyme activity, balance, concentration and function. Whenever desirable for therapeutic purposes, attempts will be made to restore or to modify normal enzymatic activities of the diseased organism. According to the official statement:

It is evident that investigative work in this direction opens up new approaches to a large variety of therapeutic problems. The development of this field has a logical companion in present trends in clinical analytical chemistry, where determinations of biological catalysts are just beginning to replace successfully the use of functional and tolerance tests and the measurement of a variety of metabolites. The program of the chemical research laboratories as described above constitutes perhaps the first instance of a joint attempt by clinicians and chemists to use recent advances in enzymology for the solution of therapeutic problems.

According to equipment the chemical research laboratories of the Ochsner Foundation consist of three units. The first unit contains modern technical facilities used in biochemical research work, including equipment for the characterization of minute amounts of material. The second unit is fully equipped for work in synthetic organic chemistry. The third unit has the instruments required for research in clinical analytical chemistry. The work of this last unit will deal with the improvement of present clinical laboratory procedures in order to approach more closely the high standards of reliability which are characteristic for other branches of analytical microchemistry.

<sup>11</sup> "Family and Community in Ireland," 1940.

### BOTANICAL SURVEY OF THE ALASKA MILITARY HIGHWAY

A SECOND expedition to the Alaska Highway, sponsored jointly by the Arnold Arboretum, the Joint Economic Committees, Canada-United States, and the Robert S. Peabody Foundation for Archaeology, returned to Boston on September 19.

The field work was in charge of Dr. Hugh M. Raup, of the Arnold Arboretum, Harvard University, and formed a continuation of investigations begun in the summer of 1943. The party included Frederick Johnson, of the Peabody Foundation for American Archaeology at Andover, Mass.; Lucy C. Raup, botanist; John H. H. Sticht, of the department of geology, Harvard University; Dr. Stuart K. Harris, of the department of biology, Boston University, and Karl and David Raup.

The necessary funds were provided by grants from the Milton Fund at Harvard, the American Philosophical Society, the National Academy of Sciences, the Society of the Sigma Xi, the Peabody Foundation and the Geological Society of America. Field equipment was loaned by the National Museum of Canada, and transportation in the field was supplied by the Northwest Service Command of the United States Army.

The party left Boston on May 31, and Whitehorse, Yukon, on June 14. Most of the season was occupied with geological, botanical and archeological reconnaissance surveys along the highway between Whitehorse and Fairbanks, thus supplementing the work of 1943 which extended from Dawson Creek to Whitehorse. The latter half of June and most of July were spent at Pine Creek in the Dezadeash River district about 100 miles west of Whitehorse, and in the Kluane Lake region. After a brief stay in Fairbanks, the party returned to the upper Tanana River district for about two weeks, and then spent another week at Kluane Lake and Pine Creek for late summer collecting. In the first ten days of September they traveled southward to Edmonton by way of Dawson Creek, with brief stops at Teslin and Muncho Lakes, Summit Pass and the Buckinghorse River.

The combined botanical collections, from two summers in the field, approximate 4,000 numbers, with ample duplicates for future distribution.

### RESEARCH CONFERENCE ON X-RAY AND ELECTRON DIFFRACTION

THE University of Pittsburgh will hold the first of a series of annual research conferences on X-ray and Electron Diffraction on Friday and Saturday, November 3 and 4. The program includes a series of papers contributed mainly by men from the University of Pittsburgh, the Carnegie Institute of Technology and

from the x-ray and electron diffraction laboratories of industries in the Pittsburgh area.

The Friday afternoon session will deal with x-ray diffraction investigations on wheat flour gluten, electrolytically deposited silver on cold rolled metals, anhydrous iron-alkali sulfates, coloring agents in mottled silica brick, sodium bicarbonate-sodium carbonate conversion and tungsten-molybdenum alloys.

On Friday evening there will be invited papers covering x-ray diffraction studies on materials of physical and metallurgical interest by Professor W. P. Davey, of the Pennsylvania State College, and on materials of biological interest by Professor I. Fankuchen, of the Polytechnic Institute of Brooklyn.

The theory and application of electron diffraction, chemical and metallurgical analyses by electron microscopy, the use of electron microscopy in confirming indirect methods for determining dimensions of colloidal particles, and special techniques in x-ray diffraction will be included in a session on Saturday morning. Participants in the conference are invited to inspect the x-ray diffraction laboratories of the district on Saturday afternoon.

All sessions will be held in the auditorium of the Mellon Institute. Any one interested is welcome to attend the conference and may secure further information concerning details from Dr. S. S. Sidhu, of the University of Pittsburgh.

### CONSULTANTS IN NUTRITION OF THE SURGEON GENERAL

To help the Army to meet the initial responsibility as well as to advise on problems of nutrition among the military forces, a group of experts in nutrition has been appointed consultants to the Surgeon General. The new appointees include:

Dr. Otto A. Bessey, chief of the division of nutrition and physiology and director of the Public Health Research Institute, New York City;

Dr. E. V. McCollum, research professor of biochemistry, School of Hygiene and Public Health, The Johns Hopkins University;

Dr. Julian M. Ruffin, associate professor of medicine, Duke University;

Dr. Frederick J. Stare, associate professor of nutrition, School of Public Health, Harvard University;

Dr. Harold C. Stuart, director, Center for Research in Child Health and Development and Department of Child Hygiene, Harvard School of Public Health.

Dr. Virgil P. Sydenstricker, professor of medicine, and physician in chief, University Hospital.

### AWARD OF THE GOLD MEDAL OF THE NEW YORK ACADEMY OF MEDICINE

The Gold Medal for distinguished service in medicine of the New York Academy of Medicine was presented to Dr. Oswald T. Avery, of the Rockefeller

Institute for Medical Research, at a meeting of the academy on October 5.

This is the first time the medal has been awarded since 1938. The previous recipients of the award are:

Dr. Carl Koller	1930
Dr. David Marine	1931
Dr. Charles Norris	1934
Dr. Alfred Newton Richards	1936
Dr. Bela Schick	1938

The citation delivered by the president of the academy, Dr. Arthur Freeborn Chace, follows:

Dr. Oswald T. Avery, for more than thirty years you have been on the staff of the Rockefeller Institute for Medical Research, and your investigations have led to

discoveries and great advances in the science of bacteriology. With Dochez, in 1917, you discovered the "soluble specific substance" of the pneumococcus, and in the early twenties you revealed that it was a polysaccharide different from each of the three types of pneumococci studied. But you have persisted for years in your quiet, modest way, and have ever given credit to others. During this present year with Mac Leod and MacCarty, you have studied the transformation of one type of pneumococcus into another and isolated the "transforming principle" as a thymonucleic acid. This discovery has very far-reaching implications for the general science of biology. I have the pleasure and the honor of presenting to you the Medal of The New York Academy of Medicine, which is awarded to one who has contributed in a distinguished way to the progress of medicine.

## SCIENTIFIC NOTES AND NEWS

DR. ERNEST W. GOODPASTURE, professor of pathology at the School of Medicine of Vanderbilt University, was presented with the Sedgwick Memorial Medal at the opening ceremonies in Philadelphia on October 3 of the War-time Conference and annual meeting of the American Public Health Association.

THE Charles Matthews Manly Medal of the Society of Automotive Engineers was awarded on October 6 to John Otto Almen, of the General Motors Research Laboratories, Detroit. The award was made in recognition of his work in developing methods and data for increasing by shot blasting the working strength of metals and of engine parts.

DR. FLORENCE SEIBERT, associate professor of biochemistry at the Phipps Institute of the University of Pennsylvania, was presented at the White House on October 6 with the medal of the National Achievement Award sponsored by Chi Omega. This award, made annually to "an American woman of notable accomplishments," was awarded to Dr. Seibert in recognition of "her outstanding research in connection with tuberculosis."

WATSON DAVIS, director of Science Service, was one of the four recipients of bronze journalism medals presented by the School of Journalism of Syracuse University at its tenth anniversary dinner on October 6 in recognition of his "distinguished service in interpretation of science."

DR. G. H. PARKER, professor of zoology emeritus of Harvard University, was elected an honorary member at the Cleveland meeting of the American Society of Naturalists.

THE honorary degree of doctor of science was conferred on September 27 by Marquette University on Brigadier General James Stevens Simmons, U.S.A.,

chief of the Preventive Medicine Service, Office of the Surgeon General, U. S. Army. On this occasion he delivered the commencement address at the School of Medicine.

OFFICERS of the Virginia Chapter of Sigma Xi have been elected as follows: *President*, Dr. Frederick L. Brown, professor of physics, to succeed Dr. Ladley Husted, of the department of biology; *Vice-president*, Dr. Robert E. Lutz, professor of organic chemistry; *Secretary*, Dr. Joseph K. Roberts, professor of physics, and *Treasurer*, Dr. Lawrence R. Quarles, associate professor of geology.

CHARLES DERLETH, JR., professor of civil engineering and until 1942 dean of the College of Engineering of the University of California at Berkeley, retired on October 2.

DR. E. C. ROSENOW, who on July 1 became emeritus professor of experimental bacteriology of the Mayo Foundation Graduate School of the University of Minnesota, will continue his research work at the California Institute of Technology.

DR. J. T. MCCLINTOCK, for forty-two years professor of physiology and head of the department in the College of Medicine of the State University of Iowa, retired on July 1. Professor H. M. Hines, of the same department, has been appointed to succeed him. Dr. Kendrick Hare, formerly of the department of anatomy, has been appointed associate professor of physiology, and Dr. S. B. Barker, of the University of Tennessee at Memphis, has joined the department as assistant professor. Dr. C. A. Winter has become assistant professor of physiology at the School of Medicine of the University of Oklahoma.

DR. ARNOLD J. LEHMAN, of the College of Medicine of Wayne University, has been appointed professor

of pharmacology in the School of Medicine of the University of North Carolina.

WILLIAM E. STANLEY, professor of sanitary engineering at Cornell University, has been appointed professor in charge of courses in sanitary engineering at the Massachusetts Institute of Technology. Professor Stanley recently returned from North Africa, where he served as a major in the Corps of Engineers with assignments as water supply officer for seven months during the North African invasion and the Tunisian campaign, and for eight months as chief of construction in the Service of Supply.

IT is reported in the daily press that Dr. Aldo Castellani has been dismissed from the professorship of tropical diseases at the University of Rome.

DR. MERVIN J. KELLY, director of research of the Bell Telephone Laboratories, New York City, has been elected executive vice-president of the laboratories. Alva B. Clark and Dr. Reginald L. Jones have been elected vice-presidents. O. B. Blackwell, vice-president, became on October 1 assistant vice-president of the American Telephone and Telegraph Company.

DR. EDWARD B. KRUMBHAAR, professor of pathology at the University of Pennsylvania, has been elected a member of the Board of Overseers of Harvard University.

DR. GUSTAVE J. MARTIN, assistant director in charge of the division of chemistry of the Warner Institute for Therapeutic Research, New York, has been made research director of the National Drug Company, Philadelphia.

DR. LYLE WINSTON PHILLIPS, of the department of physics of the University of Illinois, has joined the staff of the research laboratories of the Armstrong Cork Company.

DR. LOUIS I. DUBLIN, statistician of the Metropolitan Life Insurance Company, assistant to the chairman of the American Red Cross, will serve as acting chairman during the absence of Dr. Basil O'Connor, who is inspecting Red Cross activities in France and England.

VERNON E. BROCK has been appointed director of the Division of Fish and Game of the Board of Agriculture and Forestry of the Territory of Hawaii. He left for Hawaii late in July. Mr. Brock was chief fishery biologist with the Fish Commission of Oregon from 1940 to 1944, but has been on leave for the past year, serving as administrator of pilchard production and as production analyst in the office of the Coordinator of Fisheries in San Francisco.

LELAND G. ALLBAUGH, on leave of absence from his position as assistant director of agricultural exten-

sion at Iowa State College, is now in Rome. He is serving as consultant on seeds, feed, machinery and fertilizer in the liberated area, in connection with the Foreign Economics Administration. He is expected to return to Iowa State College next July.

AFTER a leave of absence of a year and a half, Dr. Laurence McKinley Gould has returned to his position as professor of geology and geography at Carlton College. During his absence Dr. Gould has been chief of the Arctic Section of the Arctic, Desert and Tropic Information Center of the United States Army Air Forces with headquarters in Minneapolis and in New York City.

DR. E. NEWTON HARVEY, Henry Fairfield Osborn professor of biology at Princeton University, will deliver on October 26 the first Harvey Society Lecture of the current series at the New York Academy of Medicine. He will speak on "Decompression Sickness and Bubble Formation in Blood and Tissues."

DR. ARTHUR COMPTON, professor of physics at the University of Chicago, will address the Institute on Religion and Contemporary Civilization, to be held at the University of California at Los Angeles from November 13 to 17. He will speak on the morning of November 15 on "Religion and the Scientific View of Man." That afternoon he will lead a seminar devoted to a discussion of his morning lecture. In the evening he will deliver a second address which will be entitled "What It Means to be Free."

LIEUTENANT COMMANDER LOWELL T. COGGESHALL, M.C., U. S. Naval Reserve, Marine Barracks, Klamath Falls, Ore., professor of epidemiology in the School of Public Health of the University of Michigan, will address a joint meeting of the Institute of Medicine of Chicago and the Chicago Society of Internal Medicine on Monday evening, October 23, at the Palmer House. He will speak on "Current and Postwar Aspects of Tropical Disease Problems."

MAJOR GENERAL GEORGE F. LULL, U.S.A., Deputy Surgeon General of the Army, on September 21 spoke at the annual meeting of the Jefferson Medical College Alumni Association in Philadelphia, on the reasons for the low mortality rates in this war compared with other wars.

AT St. Louis University there have been established an Institute of Geophysical Technology, with the Rev. Dr. James B. Macelwane as dean, and an Institute of Social Sciences, with the Rev. Dr. Leo C. Brown as director. The Institute of Geophysical Technology offers courses on both the undergraduate and the graduate levels leading to the degrees of bachelor and master of science and the doctorate. The Institute of Social Sciences is a graduate school, offering the master's and doctor's degrees.

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THE department of pharmacology of the School of Medicine of the University of Maryland has received a gift of \$4,000 from the Ohio Chemical and Manufacturing Company of Cleveland to establish a fellowship for the study of volatile anesthetics, especially "propylene," under the direction of Dr. John C. Krantz, Jr., professor of pharmacology. The Emerson Drug Company of Baltimore also has established a fellowship at the university of \$5,000 for the study of analgesics and the mechanism of the relief of pain to be carried out under the direction of Dr. Krantz.

AN exhibit of drawings, sketches and etchings by Dr. Charles M. Pomerate, professor of anatomy at the Medical Branch in Galveston of the University of Texas, was shown at a meeting of the Texas Surgical Society on October 2 and 3. The exhibit illustrated the evolution of a hobby developing from an interest in the technique of scientific drawing. The sketches include scenes from Normandy and other parts of France, Italy, Mexico and South America. The exhibit will remain through the meeting of the American Society of Anesthetists on November 3 and of the Texas Academy of Science from November 9 to 11.

THE Columbia Foundation of San Francisco has given the sum of \$13,800 toward the establishment of a department of tropical medicine at the Medical School in San Francisco of the University of California.

*The Experiment Station Record* reports that the School of Pan American Agriculture founded and maintained by the United Fruit Company was formally opened on Columbus Day. A provisional opening was made in September, 1943, with an enrollment of 74 students selected from Mexico and six of the Central American countries. The opening of the school followed an authorization in 1942 by the National Congress of Honduras of a location within that country. A considerable tract of land was purchased at Zamorano, about 25 miles from Tegucigalpa, the national capital. Buildings are under construction to accommodate a student body which was expected to reach the scheduled maximum of 160 by this autumn. A basically practical course of instruction is projected to run for three years, with a fourth year for students showing proficiency and capacity for specialization. Four hours each day will be devoted to field work and an equal number to study. No tuition fees are charged, and students are furnished lodging, clothing, board, books and other necessary equipment without cost. The primary purpose is to supply practical agricultural leadership for the American Tropics. The director of the school is Dr. Wilson Popenoe, formerly of the Bureau of Plant Industry of the U. S. Department of Agriculture. Other mem-

bers of the faculty include Alfred F. Butler, head of the department of agronomy and soils; Dr. H. A. Von Wald, agricultural engineering, and E. A. Rivera, livestock.

*The British Medical Journal* states that a department of child health has been established at the University of Liverpool in collaboration with the City Council and the Royal Liverpool Children's Hospital. Dr. Norman B. Capon has been appointed part-time director of the department and has been given the title of professor of child health while holding that post. He has been lecturer in diseases of children in the university since 1935 and he is also a lecturer in clinical medicine. The new department will be concerned not only with the investigation of diseases of childhood, but also with the preservation of good health, physical and mental, during the early years of life.

THE Nuffield Provincial Hospital Trust has made a grant to the Sheffield Radium Center for the salary and expenses of a biochemist who is to work in the Sheffield Cancer Laboratory, which has been maintained by the Yorkshire Cancer Council for the past fifteen years, under Professor H. N. Green, the director. A study will be made of the effects of radiation on biochemical processes in normal tissues and the immediate problem will be to determine whether small doses of radiation stimulate hyperplasia of specialized cells, by studying the excretory rate of sex hormones after irradiation of the gonads.

THE British Admiralty has announced the formation of a Royal Naval Scientific Service, in order to make permanent provision for the Navy's needs "in the fields of research, experimental design and development." It is stated in *The Times*, London, that this in effect is a change of name rather than a new departure, for the new service will be staffed by those now forming the Admiralty Scientific, Technical and Chemical Pools, at present working under the director of scientific research, who will be the head of the new service. According to the official announcement, it is planned to give the new service "the status and responsibilities commensurate with its high importance."

THE British Minister of Agriculture and Fisheries and the president of the Board of Education have jointly appointed a permanent committee of which Dr. Thomas Loveday, vice-chancellor of the University of Bristol, is chairman, to advise them on all aspects of agricultural education to be provided by local education authorities, and particularly on the educational policy and methods of training to be adopted at farm institutes. A second committee, also under the chairmanship of Dr. Loveday, has been appointed to consider the character and extent

of the need for higher agricultural education in England and Wales and to make recommendations as to the facilities that should be provided to meet the need. This committee will deal with agricultural education

provided by agricultural colleges and university departments of agriculture, and will take over the functions of the Ministry's wartime Committee on Higher Agricultural Education.

## DISCUSSION

### RECENTLY STARRED BOTANISTS AND ZOOLOGISTS

SUPPLEMENTARY to the lists of scientists first starred in the seventh edition of "American Men of Science" published in SCIENCE for August 11, the following data on where they received their academic training and their birthplaces will interest some readers. The appended summaries concerning also those starred in 1932 and 1937 are also of some interest. (Corresponding data concerning the other sciences have been assembled; those for astronomers, chemists, geologists, mathematicians and physicists are scheduled to appear in *The American Journal of Science* for November; those for psychologists, in *The American Journal of Psychology* for October.)

#### BOTANISTS FIRST STARRED IN THE 7TH EDITION AMERICAN MEN OF SCIENCE

##### Present distribution by institutions:

California: Chandler, W. H., Foster, A. S., Stebbins, G. L.; Harvard: Linder, D. H., Mangelsdorf, P. C., Thimann, K. V.; Carnegie Institution: Clausen, J. C., McClintock, Barbara; U. S. Department of Agriculture: Auchter, E. C., Drechsler, C.; California Institute of Technology: Anderson, E. G.; Boyce Thompson Institute: Arthur, J. M.; Columbia: Karling, J. S.; Connecticut State College: Avery, J. S.; Cornell: Muenscher, W. C.; Duke: Wolf, F. A.; Iowa: Loehwing, Martin; North Carolina: Couch, J. N.; Pennsylvania State: Overholts, L. O.; Rockefeller: White, P. R.; George Washington: Griggs, R. F.; Wisconsin: Keitt, G. W., Riker, A. J.; Yale: Burkholder, P. R.

##### Doctorate: ACADEMIC TRAINING

Cornell: Anderson, Auchter, Burkholder, McClintock, Muenscher, Wolf; Harvard: Drechsler, Foster, Griggs, Linder, Mangelsdorf, Stebbins; Chicago: Arthur, Loehwing, Martin; Columbia: Karling; Hopkins: White; Missouri: Chandler; North Carolina: Couch; Washington University: Overholts; Wisconsin: Avery, Keitt, Riker; Copenhagen: Clausen; London: Thimann.

##### Collegiate:

Chicago: Arthur, Loehwing; Clemson: Keitt; Cornell: Auchter, Foster, McClintock; Dickinson: Burkholder; Harvard: Linder, Stebbins; Kans. State Coll.: Mangelsdorf; Miami: Overholts; Missouri: Chandler; Montana: White; Nebraska: Anderson, Wolf; North Carolina: Couch; Oberlin: Riker; Ohio: Griggs; Rutgers: Martin; Texas: Karling; Tulane: Avery; Washington St. Coll.: Muenscher; Wisconsin: Drechsler; Copenhagen: Clausen; London: Thimann.

##### Birthplaces:

Midwest 7, South 4, New England 3, New York 4, Pennsylvania 1, Nebraska 2, Montana 1, England 1, Denmark 1, Germany 1.

#### BOTANISTS STARRED 1932-1944

##### Distribution:

California 7, Harvard 6, Cornell 4, Columbia 3, Illinois 3, Iowa 3, Michigan 3, Minnesota 3, Wisconsin 3, Calif. Tech. 2, Iowa State 2, Pennsylvania 2, U. S. Department of Agriculture 5, Boyce Thompson Institute 4.

##### Doctorate:

Chicago 13, Harvard 13, Cornell 11, Wisconsin 7, Hopkins 6, Pennsylvania 3, California 2, Michigan 2, Missouri 2, Washington University 2.

##### Collegiate:

Cornell 4, Missouri 4, Chicago 3, Harvard 3, Michigan 3, Pennsylvania 3, Toronto 3, Iowa State Col. 2, Kans. State Col. 2, Mich. State Col. 2, Wisconsin 2, Illinois 1, Missouri 1, Oberlin 1, Stanford 1.

#### ZOOLOGISTS FIRST STARRED IN THE 7TH EDITION AMERICAN MEN OF SCIENCE

##### Distribution by institutions:

California: Brooks, S. C., Kirby, H., Light, S. F.; Columbia: Barth, L. G., Pollister, A. W.; Michigan: Dice, L. R., Okkelberg, P.; Northwestern: Buchanan, J. W., Turner, C. L.; Stanford: Beadle, G. W., Ferris, G. G.; Amherst: Schotte, O. E.; California Institute of Technology: Tyler, A.; Chicago: Park, Thomas; Cornell: Adelmann, H. B.; Haverford: Dunn, E. R.; Hopkins: Ephrussi, B.; Illinois: Kudo, R. R.; Indiana: Sonneborn, T. M.; Iowa: Beams, H. W.; Kansas State Col.: Ackert, J. E.; Massachusetts Institute of Technology: Schmidt, F. O.; Oberlin: Hibbard, H.; Ohio: Kennedy, C. H.; Princeton: Butler, E. G.; Rutgers: Boyden, A.; Swarthmore: Irving, L.; Washington (St. Louis): Hamburger, V.; Wisconsin: Irwin, M. R.; Yale: Young, W. C.

American Museum of Natural History: Breder, C. M., Mayr, E.; Chicago Museum of Natural History: Schmidt, K. P.; N. Y. Zoological Park: Gordon, M.; Philadelphia Academy of Natural Science: Rehn, J. A.; U. S. Department of Agriculture: McIndoo, N. E.; U. S. National Museum: Friedmann, H.

#### ACADEMIC TRAINING

##### Doctorate:

Cornell: Adelmann, Beadle, Friedmann, Gordon, Kennedy; Chicago: Barth, Buchanan, Park, Young; California: Dice, Kirby, Light; Wisconsin: Beams, Boyden, Turner; Bryn Mawr: Hibbard; California Institute of Technology: Tyler; Columbia: Pollister; Harvard:

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Brooks, Dunn; Hopkins; Sonneborn; Illinois: Ackert; Iowa State College: Irwin; Michigan: Okkelberg; Pennsylvania: McIndoo; Princeton: Butler; Stanford: Irving; Washington (St. Louis): Schmidt, F. O.; Berlin: Mayr; Freiberg: Hamburger; Geneva: Schotte; Paris: Ephrussi; Tokyo: Kudo. (No Ph.D., 4.)

## Collegiate:

Cornell: Adelmann, Gordon, Schmidt; Amherst: Young; Bates: Pollister; Bowdoin: Irving; Chicago: Park; Columbia: Tyler; Emory: Kirby; Fairmount: Beams; Haverford: Dunn; Hopkins: Sonneborn; Illinois: Ackert; Indiana: Kennedy, McIndoo; Iowa State College: Irwin; Massachusetts College: Brooks; Michigan: Barth; Minnesota: Okkelberg; Missouri: Hibbard; Ohio (Athens): Buchanan; Ohio Wesleyan: Turner; Nebraska: Beadle; New York City College: Friedmann; Park: Light; Stanford: Dice, Ferris; Syracuse: Butler; Washington (St. Louis): Schmidt, F. O.; Wisconsin: Boyden; Germany: Hamburg, Mayr; other foreign 3; no college reported 2.

## Birthplaces:

New England 2, New York 4, Pennsylvania 2, New Jersey 1, Illinois 4, Indiana 2, Iowa 1, Kansas 3, Michigan 1, Minnesota 1, Missouri 1, Nebraska 1, Ohio 2, Wisconsin 1, Maryland 1, Virginia 1, Georgia 1, Canada 1, Russia 3, Germany 2, Japan 2.

## ZOOLOGISTS STARRED 1932-1944

## Distribution:

Columbia 7, Stanford 6, California 5, Michigan 5, Chicago 4, Harvard 4, Rochester 4, Cornell 3, Northwestern 3, Princeton 3, California Institute of Technology 2, Illinois 2, Indiana 2, Minnesota 2, New York University 2, Oberlin 2, Ohio 2, Yale 2. With 1 each (in addition to those having a man starred in 1943): Clark, Connecticut College, Holyoke, Missouri, Sarah Lawrence, St. Louis, Trinity, Tulane, Western Reserve. Also American Museum of Natural History 3, Carnegie 1, U. S. National Museum 2.

## Doctorate:

Harvard 16 (10 in 1932), Columbia 12, Cornell 12, Chicago 9, Illinois 7, California 5, Wisconsin 5, Yale 5, Bryn Mawr 2, Hopkins 3, Michigan 3, Princeton 2, Stanford 2.

## Collegiate:

Cornell 8, Stanford 5, Amherst 4, New York City College 4, Chicago 3, Columbia 3, Indiana 3, Missouri 3, Bowdoin 2, Dartmouth 2, George Washington 2, Harvard 2, Illinois 2, Michigan 2, Minnesota 2, Rutgers 2, Syracuse 2; 1 each from about 30 others.

## Birthplaces of all starred zoologists:

New England 73, Middle Atlantic States 99, East North Central States 82, West North Central States 47, South Atlantic 22, South Central 6, Mountain States 3, Pacific States 3, Canada 8, Germany 11, Russia 7, Britain 5; other Europe 8.

STEPHEN S. VISHER

INDIANA UNIVERSITY

ERGOSTEROL FROM SOME SPECIES OF *PENICILLIUM*

IN a recent communication Zook, Oakwood and Whitmore<sup>1</sup> reported the presence of approximately 1 per cent. of ergosterol in the dry mycelium of *Penicillium notatum*.

Data have been collected in our laboratory over a period of time on the ergosterol content of *P. notatum*, *P. chrysogenum* and *P. citrinum* as cultivated under various conditions. We have found that ergosterol is present only in surface culture material. The ergosterol was determined by spectrographic quantitative analysis and in several instances confirmed by isolation of the sterol, determination of its physical properties and preparation of derivatives.

A *P. notatum* surface culture strain, obtained from penicillin production batches, yielded ergosterol: by direct extraction and isolation, 1.06 to 1.09 per cent. of the dry mold; by spectrographic analysis, 1.10 per cent. The mold in this case had been cultivated on a lactose medium. Cultivation on a starch medium yielded a mycelium containing 1.05 per cent. ergosterol by spectrographic analysis.

A *P. notatum* submerged culture strain, obtained from production batches, yielded no ergosterol by direct extraction, and only traces were indicated spectrographically.

A strain of *P. chrysogenum*, grown as a surface culture, showed 1.0 to 1.1 per cent. of ergosterol.

*P. citrinum*, the mold which produces citrinin, contained 1.1 to 1.3 per cent. ergosterol as determined by direct isolation.

It will be observed that several species of *Penicillium* show consistently about 1.1 per cent. ergosterol in the dry mold when cultivated as a surface culture. Submerged fermentation appears to be unfavorable for ergosterol production.

C. J. CAVALLITO

WINTHROP CHEMICAL COMPANY, INC.,  
RENSSELAER, N. Y.

## SOLUTION OF THE CUBIC EQUATION

IN view of the many valuable features of the recent "Webster's Biographical Dictionary" (1943) and its wide usefulness in the schools it may be desirable to note here that it fails to give due credit to H. Cardan in regard to the progress in the solution of the general cubic equation as developed in his noted "Ars Magna" (1545). Under the name of Tartaglia in the present work it is said that he is credited with the discovery of the solution of the cubic equation, later published by G. Cardano as his own; and under the name of Cardano it is asserted that he gave as his own the cubic solution which he had obtained from Tartaglia, the discoverer.

<sup>1</sup> Zook, Oakwood and Whitmore, SCIENCE, 99: 427, 1944.

These statements are in accord with the common views in regard to Cardan about twenty years ago and are supported by many references in more recent mathematical text-books. It is, however, easy to verify that they are untrue since Cardan's publications relating to the solution of the cubic equation are still extant and have been extensively quoted in recent literature. In particular, Cardan referred to the work of Tartaglia in his "Ars Magna" as well as to that of an earlier worker along the same line who made substantial contributions. Much earlier steps towards the solution of the cubic equation by the ancient Babylonians were noted by O. Neugebauer in his "Geschichte der Antiken Mathematischen Wissenschaften" (1934).

Both the solution of the general quadratic equation and the solution of the general cubic equation are dependent on the theory of complex numbers and there is no evidence that Tartaglia was familiar with this theory. Hence he could not have solved the general cubic equation in the modern sense of the term. It is also true that H. Cardan could not have solved this equation even if he made slight formal use of complex numbers in his "Ars Magna." The history of the development of the number concept furnishes the key to many other inaccurate assertions in the history of mathematics. It also simplifies this history by uniting many related advances. In particular, the reputation of H. Cardan has greatly improved as a result of recent studies.

G. A. MILLER

UNIVERSITY OF ILLINOIS

#### IMPROBABILITY AND IMPOSSIBILITY

THE statistical determinism which, around the beginning of the century, replaced the rigid determinism of Laplace, led to the replacement of the word "impossible" by the words "highly improbable." Practically, it is admitted that the two terms convey the same meaning. But only practically. Theoretically, the scientist must always remember that they are not identical, and that such "impossible" feats as the freezing of water on a gas stove, or the spontaneous rise of a brick are conceivably possible, although highly improbable.

Unavoidably, such an attitude affected our philosophical ideas. When Heisenberg introduced his "Principle of Indeterminacy," the old determinism received its death blow and became theoretically defunct. But this theory restored the significance of the word "impossible," with all its force. It was no longer a question of high improbability which affected our complete knowledge of both the speed and the position of an electron. It became a matter of absolute impossibility, owing to the influence of the observa-

tion on the phenomenon, which does not enter into play in classical mechanics.

Of course this indetermination affects only sub-atomic particles. But, statistically, it also affects phenomena on our scale of observation, so that it had to be taken into account in wave mechanics. However, on our scale of observation, in our macroscopic world, it is still difficult to think of an observation which would be at the same time practically and theoretically impossible. Yet there is at least one, which can be worded in the following way: "What is the color of the emulsion of an unexposed photographic plate?"

The answer is that we can not know it, and that it will never be experimentally checked.

Naturally it must be borne in mind that this question merely tends to emphasize the parallelism between a sub-atomic and a macroscopic phenomenon, namely, the influence of the observation on the phenomenon and the impossibility of the observation. The writer is well aware that the term "color" involves the sensitivity of the retina and that a substance is devoid of "color" in the dark. Shall we then say that an unexposed photographic film is colorless? But what is the exact meaning of the word "colorless"? Does it qualify only the receptor (the eye) or does it correspond to an actual quality of the object expressing some of the specific properties (absorption, reflection) of the molecules which manifest themselves on our scale of observation by our physiological reaction? We know that electronic rearrangements take place as soon as photons hit the emulsion, and that these changes can be detected by an appropriate chemical treatment. But that is all. And, if nothing more, this simple observation may lead to an accurate definition of the term "colorless."

The writer would be much interested in any comments on this subject.

LECOMTE DU NOÜY

ECOLE DES HAUTES ÉTUDES, PARIS

#### DISTRIBUTION OF DUPLICATE PLATES FROM THE DEAN MEMORIAL VOLUME

THE completion of the "Bashford Dean Memorial Volume: Archaic Fishes" has left on my hands considerable numbers of plates left over from making up the various articles in the volume. Desirous of placing these where they will be appreciated and used, I shall be glad to send them gratis to teachers and students of embryology and comparative anatomy who may wish them.

Address requests to:

E. W. GUDGER,

*Editor, Dean Memorial Volume*  
AMERICAN MUSEUM OF NATURAL HISTORY,  
NEW YORK 24, NEW YORK

## SCIENTIFIC BOOKS

## MARINE ALGAE

*Marine Algae of the Monterey Peninsula, California.*

By GILBERT M. SMITH. ix + 622 pp., incl. 98 pl. Stanford University Press. 1944.

IT is definitely an event in biology when the first comprehensive account of an important group of plants for any area becomes available. For the western coast of the United States but few attempts have been made to list all the marine algae. The earlier lists were admittedly fragmentary. Setchell and Gardner in their later years, attempting a complete manual, covered the smaller groups but not the most difficult, the "red" algae. Consequently Smith's manual, although for a limited area, is the first comprehensive marine flora designed for use on the Pacific coast. The nineteenth century writers had but a few scattered specimens on which to base their reports, and even Setchell and Gardner in their earliest complete account (1903) with less than ten years of field experience had relatively few, whereas Smith had available all the accumulation of a very long generation of intensive collecting and publication on their part over the whole coast line, and a number of years on his own over his particular territory. Consequently he was in a position to do, and has done, a thorough job. The book lists about 385 species; the author estimates that this is 80 per cent. of the flora of the western United States shores between southern California and Puget Sound. The large proportion of the western flora encompassed justifies him in presenting the local flora of a few miles of shore line with the elaborateness of a major taxonomic work.

The introduction to this work opens with a brief sketch of phycological study on the Pacific coast, and more particularly Monterey, information not previously brought together. In it appears, together with the notable early explorers and botanists, those amateurs whose collections so generously aided the studies of the later botanists Farlow, Setchell and Gardner. The writer brings out the fact that three or four early English explorers of the west coast collected a few striking algae at Monterey—Menzies in 1792 for instance, whose species were published by Dawson Turner, and those collected by Douglas and by Thomas Coulter which were described by W. H. Harvey. The later group of collectors after Coulter were largely residents of the west, and with them our detailed knowledge of the flora really begins.

The author of the book under review came to the study of these plants indirectly, for after sundry smaller works he prepared two volumes of an important taxonomic work on Wisconsin fresh-water phytoplankton, and then digressed to the preparation of text-books, first on fresh-water algae, then on crypto-

gams in general. However, though Smith went to Stanford a recognized authority on fresh-water and particularly plankton algae, he found opportunities in California for this kind of work less attractive than those for marine observations, to which he then turned. He withstood the temptation to study the flora of the whole west coast, an enterprise upon which Setchell and Gardner embarked but which they failed to complete, and concentrated on a small geographical area of notable floristic importance. This is in the temperate zone of algal distribution, which is the richest zone on this coast yet comprehensively explored. Furthermore, there is a local area on the Peninsula for forms normally of more southern distribution.

After sketching earlier algal studies at Monterey, the author gives a description of the physiography and vegetation of the district. This section, which could hardly be made adequately detailed in a work of larger geographical scope, might advantageously have been considerably larger here where the field is circumscribed, and have gone into matters of local distribution and ecology in greater detail. There is a useful, detailed designation and description of various localities in the Monterey region, which connects obsolete and popular place names with official ones. The directions for the collecting of algae are excellent; they are rather widely applicable to procedure in cold water, but not altogether suited to milder regions.

The author has spared no pains to make generic and supergeneric descriptions inclusive of the best and most recent studies in the morphology and life histories of these algae; for instance, those in the Phaeophyta dealing with alternating generations and the sexual or non-sexual function of the plurilocular reproductive organs, and in the Rhodophyta dealing with carpogenic apparatus and cystocarp development. Elements still controversial creep in here, however, especially in the Phaeophyta. The author has continued in this volume his policy of revising the major divisions of the algae to afford what he considers a more just recognition of the importance of groups of equal value. This appears first in his elevation of algal classes to the rank of divisions, a move he has favored before.<sup>1</sup> Few except perhaps some phycologists will be pleased with a classification of the plant kingdom into perhaps a dozen divisions, seven of which are algae! It is of little advantage in the present case, since but one class appears in each of these divisions involved except the Phaeophyta, where

<sup>1</sup> G. M. Smith, "Cryptogamic Botany," Vol. 1, "Algae and Fungi," p. 6. vii + 545 pp., 299 fig. New York: McGraw-Hill Company, 1938.

the old term Phaeophyceae disappears altogether, and where he recognizes as classes the Isogeneratae, Heterogeneratae and Cyclosporeae. The group definitions seem quite precise in this particular book and grant no latitude in the principal character involved, the relative stature of the alternating generations. This is unfortunate, for it is evident at once that some of the genera do not conform to the specifications for the Heterogeneratae and Isogeneratae (*Cutleria*, 1938, p. 240). The class definitions should better have described the range of forms included, rather than just the climax type in this respect. A peculiar and unfortunate situation has developed in the treatment of the Haplostichineae. Originally distinguished by its compound filamentous structure, as contrasted with the parenchymatous structure of the Polystichineae, this group is reasonably distinct. The trouble lies in the prescription of trichothallie growth for it. This peculiar manner of growth is classically illustrated by *Cutleria* and is not characteristic of many of the genera Smith places in it, notably *Myrionema* and in general the Chordariales. Smith's definition of the term *trichothallic* is so unrestrictive that it permits this unfortunate treatment (p. 22). Setchell and Gardner (e.g., 1925, pp. 398, 544)<sup>2</sup> used this term very loosely and Smith seems to have even further departed from its exact meaning.

While thus dividing the Phaeophyta, the author leaves the Rhodophyta with but one class, maintaining the long-accepted subdivisions of Bangioideae and Florideae as subclasses. One notes that Smith retains as class designations Chlorophyceae and Rhodophyceae, but when he comes to subdivide the Phaeophyta his classes do not conform to the same pattern. The International Rules expressly recommend (1935, p. 5, Rec. viii)<sup>3</sup> avoidance of such confusion.

In general the descriptions are divided into three paragraphs, dealing respectively with the general body form and structure of the plants, their asexual and sexual reproduction. This is a very nice feature, enabling attention to be focused on the portion of the description needed. Within these paragraphs the author has departed from the cumbrous classical descriptions with a succession of dependent phrases and substituted sentence form. Since, however, he has frequently not been particular about complete sentence structure or consistent in the use of articles, they do not always read smoothly. It seems redundant to repeat in nearly every species description the

<sup>2</sup> W. A. Setchell and N. L. Gardner, "The Marine Algae of the Pacific Coast of North America," III. "Melanophyceae." Univ. California Pub. Bot. 8(3): 383-898. Pl. 34-107. 1925.

<sup>3</sup> J. Briquet, "International Rules of Botanical Nomenclature." Edition 3. 152 pp. Jena: Gustav Fischer, 1935.

guarding phrase, "as found on the Monterey peninsula . . .," a qualification discussed for the book on p. v. The phrase heading each subdivisional key, ". . . in the Local Flora," is a limitation to be tacitly assumed. Likewise it seems needless in those instances where there is but one representative of a subdivision to put in such a heading as: "With one Genus in the Local Flora," or other like phrase, the fact being obvious.

Citations with the several species are essentially designed to cover only the synonyms as involved in the west coast algal literature and references to the plant in the Monterey district. Separate citation of papers dealing with the morphology and life history of the genus most conveniently follow the genus description.

The distribution of the various species is dealt with in three entries. First in order, the local Monterey distribution is given in close detail, including depth at which the plants grow and the characteristic substratum, but rarely anything regarding their seasonal prevalence, useful information which must certainly have been available for most of them. Following this is given the type locality, but nothing more regarding world distribution. Lastly, and probably it should most usefully have come first, the range of the species on the Pacific coast is given. The species descriptions are nearly all based rather rigorously on local material; the descriptions suffer thereby in their applicability to the same species over its complete range, where greater diversity of size and form may be expected. Since these descriptions are thoroughly worked out anew they present considerable new information, a valuable feature.

The typography is attractive, and the proofreading on the whole has been good. The paper is thick, producing a rather plump book; the cloth binding is light in color and probably easily disfigured. The figure of *Postelsia* on the front cover is striking, but not as well reproduced as the same subject on the wrapper.

The book is amply and very handsomely illustrated, the drawings all original, and the reproduction is excellent. Nowhere is so large a proportion of the Pacific algal flora illustrated; many of the species are nowhere else adequately portrayed. An approximation of an illustration for each species is reached. The habit drawings are of great beauty of execution, and generally, so far as the reviewer has been able to compare them, representative of the plants concerned. However, he has reservations regarding a very few, such as *Enteromorpha compressa* and *Gelidium pusillum*. The drawings of smaller structures are likewise clear and well done, though sometimes reproduced on a needlessly large scale (pl. 41, fig. 1, pl. 49, pl. 82, fig. 3) and too crowded on the plate (pl. 12, figs. 4-6, pl. 48). The irregular plate length met with in some

instances (pls. 77-81) could have been improved by better spacing and slightly greater reduction of some of the drawings, without loss of detail.

These somewhat technical points will probably only bother the specialist slightly, and the general botanist will find Smith's "Marine Algae" as attractive and useful as his other books have shown themselves to have

been. Since the time is not ripe for a flora covering the whole western coast line, Smith has done biologists a great service in providing them with an excellent algal manual covering the adequately known part of its flora.

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## SPECIAL ARTICLES

### CHEMICAL BASIS OF FEVER<sup>1, 2</sup>

FEVER, as a rule, is associated with some form of cell injury. The writer has recently demonstrated the presence of a substance in inflammatory exudate which *per se* offers a reasonable explanation for the pattern of injury in inflammation.<sup>3, 4</sup> This substance has been termed necrosin. It is located in the euglobulin fraction of exudates. Preliminary studies undertaken by Major A. Mirsky and the writer indicate that this toxic substance may well be a proteolytic enzyme or, at least in its present state of purification, it contains proteolytic activity. These earlier studies have also demonstrated that the euglobulin fraction of exudates, recovered by ammonium sulfate fractionation, is pyrogenic when introduced into the circulating blood of dogs.<sup>4, 5</sup> Moreover, it has been pointed out that none of the other protein fractions of exudates are fever-inducing. Inasmuch as the active material is also recovered in the blood stream of an animal with a concomitant inflammation,<sup>4</sup> it is conceivable that the absorption of the toxic euglobulin fraction of exudates from the site of injury may help in explaining the development of fever accompanying inflammatory processes.

The studies have been carried out on rabbits<sup>6</sup> with exudate and with various fractions extracted from it. The exudate, as a rule, has been obtained from the pleural cavity of dogs previously injected with an irritant as described in an earlier study.<sup>4</sup> In several instances the material was obtained from human sources.

The fraction to be tested is introduced into the marginal ear vein of rabbits, and the rectal temperature is recorded periodically during an interval of approximately six hours. The temperature of a normal rabbit scarcely varies during such a period, the maximum increase averaging 0.63° F. In excess-

sively hot days, there may be in the rabbit an increase in temperature of about 1° F. The introduction of saline, the euglobulin fraction of normal human or canine serum, the pseudoglobulin fraction of exudates (*i.e.*, the leukocytosis-promoting factor)<sup>7</sup> and the albumin fraction of exudates have all been quite ineffective in inducing any appreciable rise in temperature. The average increase in such a series of rabbits has been 0.66° F.

The introduction, on the other hand, of exudative material into the ear vein of rabbits elicits within about an hour or two a conspicuous increase in temperature, averaging 2.37° F. This pyrogenic effect is duplicated by the euglobulin fraction of exudates, the average rise being 2.46° F. Normal non-hemolyzed serum induces a negligible rise averaging 1.05° F. Hemolyzed serum, on the contrary, induces a somewhat more conspicuous rise averaging almost two degrees Fahrenheit. This finding suggests the possibility that ruptured red corpuscles liberate an appreciable amount of pyrogenic factor into the general circulation. The observation deserves further consideration, especially in regard to various conditions, such for instance as are encountered in malaria. It may well be that the chills and fever manifested in this disease are in part referable to the release of the pyrogenic factor from red cells. Furthermore, the pyrogenic factor is recovered to some extent in the non-hemolyzed serum of an animal with a concomitant inflammation. This is suggestive that the factor is absorbed into the circulation from the site of injury.

In contrast to what is known of ordinary euglobulins, necrosin has been observed to be insoluble in the presence of NaCl or sulfate ions.<sup>6</sup> This finding, at first, had been interpreted as the possible manifestation of an atypical euglobulin.<sup>6</sup> Pursuing the study further it has recently been found that one can dissociate and obtain from the whole fraction a true euglobulin soluble in the presence of  $SO_4^{2-}$ , leaving an insoluble residual fraction behind. The procedure adopted is as follows: The exudate, obtained usually from the pleural cavity of dogs, is treated with am-

<sup>1</sup> From the Fearing Research Laboratory, Free Hospital for Women, Brookline, Mass.

<sup>2</sup> These studies were aided by grants from the Johnson and Johnson Research Foundation, New Brunswick, N. J., and the Dazian Foundation for Medical Research.

<sup>3</sup> V. Menkin, SCIENCE, 97: 165, 1943.

<sup>4</sup> *Ibid.*, Arch. Path., 36: 269, 1943.

<sup>5</sup> *Ibid.*, Proc. Soc. Exper. Biol. and Med., 54: 184, 1943.

<sup>6</sup> *Ibid.*, Federation Proc., 3: March, 1944.

<sup>7</sup> *Ibid.*, "Dynamics of Inflammation," Macmillan Company, New York, 1940.

monium sulfate at one-third saturation. The precipitate formed is treated with distilled water prior to dialysis of the  $\text{SO}_4^=$  ions. A true euglobulin enters into the aqueous phase containing the  $\text{SO}_4^=$  ions. This is neerosin in a further state of purification. It is lethal to mice and is capable of inducing a severe cutaneous inflammation in rabbits; but it is essentially non-pyrogenic. The pyrogenic factor seems primarily associated with the precipitate which has failed to dissolve in the aqueous phase containing the  $\text{SO}_4^=$  ions. This highly fever-inducing substance is readily dried by freezing. For the sake of convenience it is termed "pyrexin." The liberation of pyrexin at the site of inflammation and its absorption into the circulation offers a reasonable explanation for the basic mechanism of fever with inflammation. In a series of 10 experiments it was found that pyrexin elicited a rise in the temperature of rabbits averaging  $2.46^\circ$  F. This is of the same magnitude as that obtained with the whole euglobulin fraction of exudate. On the other hand, purified neerosin, *i.e.*, in the form of a typical euglobulin, in a similar series scarcely increased the temperature level, the average enhancement being  $0.94^\circ$  F. Whole exudative material in this series of experiments caused a hyperthermia averaging  $2.25^\circ$  F. over the basal level. These experiments support the view that there is a pyrogenic factor in inflammatory exudates. This factor is associated with the euglobulin fraction, but contrary to a typical euglobulin or purified neerosin it is essentially insoluble in the presence of various salts. This pyrogenic factor is pyrexin. Smith and Smith<sup>8</sup> have recently described the toxic properties of the euglobulin fraction of menstrual fluid. Owing to the insolubility of the material in the presence of certain electrolytes, they have inferred that an atypical euglobulin was involved. The writer has demonstrated with the material of these investigators that it likewise contains marked pyrogenic activity. It is quite possible that this is referable to the presence of pyrexin alongside with the toxic material described by Smith and Smith. This view would probably account for the apparent atypical chemical behavior of the whole toxic euglobulin fraction of menstrual fluid.

Pyrexin is thermostable. Boiling fails to inactivate it appreciably, while ashing destroys all activity. Its heat stability may prove to be of clinical value in various central nervous system disorders, *e.g.*, luetic states, in the treatment of which there must also be assurance of all absence of even traces of neerosin impurity. The thermolability of the latter would dispose of any such possibility.

Purified neerosin is, as mentioned above, highly

<sup>8</sup> O. Smith and G. van S. Smith, *Proc. Soc. Exp. Biol. and Med.*, 55: 285, 1944.

toxic and injurious to tissues; whereas pyrexin is innocuous to mice and it induces no appreciable cutaneous reaction in rabbits.

The formation of pyrexin may be closely linked to neerosin. The essentially non-pyrogenic property of the latter can often be transformed, by mere incubation for several hours, into a powerfully pyrogenic fraction. This evidence is suggestive that pyrexin may be an end product of proteolytic hydrolysis initiated by enzymatic activity associated with neerosin. Thus, pyrexin may perhaps be an enzymatic product of neerosin acting on a euglobulin substrate.

In a dog with an experimental pleurisy, pyrexin is eliminated, at least to some extent, in the urine whence it can be demonstrated in the untreated fluid or frequently be recovered as a precipitate which forms slowly in a refrigerator by the interaction of urine with ammonium sulfate at one-third saturation.

The nitrogen and phosphorus contents of pyrexin are about 11 per cent. and 1 per cent., respectively. The material is Biuret negative but Ninhydrin positive, except in the fraction recovered from urine, which is also usually Ninhydrin negative. It is Molisch negative. It is insoluble in ether and 95 per cent. alcohol. It seems to be soluble in weak alkali, but it is insoluble in strong acids. It fails to be inactivated by crystallized trypsin. Nevertheless, the possibility of a peptide attached to a nucleic acid derivative is not precluded by the available data. The exact chemical nature of pyrexin is, however, unknown and will therefore require further studies. Inhibitory action of barbiturates and antipyretics on the activity of pyrexin suggests that the possible mode of action of pyrexin is on fever centers presumably located in the hypothalamic region. This and various studies on the nature of pyrexin are being investigated further. The details pertaining to the present communication will appear elsewhere *in extenso*.

In conclusion it seems as if the basic mechanism of fever accompanying inflammatory processes is primarily referable to the liberation by injured cells of a nitrogenous substance, termed pyrexin, recovered in the euglobulin fraction of exudates; and which is possibly an end product of proteolytic activity associated with neerosin. The absorption of this active substance into the circulation offers a reasonable explanation for the development of fever.

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#### TELANG LIVER AND VITAMIN A TOXICITY

DURING the past two years we have been making an investigation of the nutritional value of the telang

type of beef liver. Condemnations of livers for telangiectasis represent a tremendous waste of a valuable food since the condition occurs in nearly 3 per cent. of a total of nine million cattle marketed each year in the United States.<sup>1</sup>

The livers from affected animals show dark red or purplish sunken areas throughout the entire organ. Attempts to ascertain the cause of this liver condition by histopathological studies<sup>2</sup> have been quite unsuccessful and since the literature does not report any diagnosis of the condition in living animals, obviously treatment has not been prescribed.

The toxicity to weanling rats of a large number of different telang livers has been investigated. These studies revealed that about 20 per cent. of the diseased livers were toxic to rats when fed as the sole diet plus a daily supplement of twenty-five milligrams of calcium carbonate. The calcium carbonate was added to correct the undesirable Ca:P ratio (about 1:16) in the beef liver. Constant symptoms observed in young rats fed the toxic telang liver were growth failure and the development of multiple spontaneous fractures of the extremities. Usually bone fractures were observed in the animals after a week to ten days of liver feeding and fatalities occurred about a week after the onset of the symptoms.

The close similarity of these toxic effects of telang liver to those observed in rats fed high amounts of vitamin A<sup>3</sup> suggested that abnormally high stores of this vitamin might be present in some of the telangiectatic livers. Previous studies in this laboratory<sup>4</sup> on the comparative vitamin content of telang and normal livers had disclosed that vitamin A storage was in general greater in the former type of liver. Vitamin A was determined colorimetrically by the method of Davies<sup>5</sup> in a specific series of six telang livers, two of which had been toxic to young rats. The results of these analyses and the growth and toxicity data for rats fed the livers are shown in Table 1. These data revealed that the toxicity of a liver and its vitamin A content were closely correlated and that the amount of the vitamin ingested by rats receiving the calcium supplemented liver as their sole dietary was in excess of the reported toxic dosage of 15,000 I.U. per day.<sup>3</sup>

<sup>1</sup> H. R. Smith, *Proc. 23rd Ann. Meet. Amer. Soc. Animal Prod.*, 272-276, 1940.

<sup>2</sup> A. Carta, *Profilassi*, 11: 43-53, 1938; F. Schote, *Inaug. Disa.*, Friedrich-Wilhelma University of Berlin, 1936.

<sup>3</sup> A. W. Davies and T. Moore, *Biochem. Jour.*, 28: 288, 1934; C. A. Baumann and T. Moore, *Biochem. Jour.*, 33: 1639, 1939; K. Rodahl and T. Moore, *Biochem. Jour.*, 37: 166-168, 1943; H. W. Josephs, *Amer. Jour. Dis. Child.*, 67: 33, 1944.

<sup>4</sup> Unpublished data.

<sup>5</sup> A. W. Davies, *Biochem. Jour.*, 27: 1770, 1933.

TABLE 1  
VITAMIN A CONTENT AND TOXICITY OF WEANLING RATS  
OF TELANG LIVERS

No. of telang liver	Vitamin A content	Intake of vitamin A per rat per day*	Time for symptoms to develop	Growth of rats
1	121,000	22,990	7	0
2	132,000	25,080	7	0
3	68,400	12,996	no symptoms	15
4	50,800	9,652	"	20
5	45,200	8,488	"	29
6	59,000	11,210	"	26

\* Intake of vitamin A calculated from food consumption data.

Subsequent experiments in which crystalline vitamin A suspended in corn oil was fed to weanling rats as supplements to a complete stock ration, or to non-toxic liver, have demonstrated that the telang liver toxicity was a hypervitaminosis A. Identical symptoms of bone fragility and growth failure were observed in rats fed 20,000 I.U. of crystalline vitamin A as a supplement to the grain stock ration. If non-toxic liver supplying 10,000 I.U. of vitamin A per rat per day was fed, the symptoms of toxicity could be produced by a daily supplement of 10,000 I.U. of the crystalline vitamin.

Relative to use of telang livers in human and animal diets, there is little probability that the amount of liver usually eaten would furnish sufficient vitamin A to produce toxic symptoms. Certainly prolonged ingestion of large amounts of telang liver would be necessary to produce any irreversible changes such as noted in the rat experiments reported herewith.

#### SUMMARY

(1) About 20 per cent. of fresh telang livers were toxic to weanling rats receiving the calcium supplemented livers as their sole dietary.

(2) The symptoms observed in rats were growth failure and multiple spontaneous fractures of the bones of the extremities.

(3) The toxicity of certain telang livers was due to their abnormally high stores of vitamin A. When these livers, supplemented only with calcium carbonate, were fed to weanling rats, the daily intake of vitamin A was in excess of the toxic dosage of 15,000 I.U. per day.

(4) Identical symptoms of toxicity were observed in weanling rats fed 20,000 I.U. of crystalline vitamin A per day in conjunction with a standard stock ration.

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### EXCHANGE REACTIONS OF DIIODOTYROSINE

RADIOACTIVE iodine has found increasing use in recent years in attempts to elucidate the mechanism by which iodine is metabolized by the thyroid gland. Generally, methods<sup>1, 2, 3</sup> previously worked out for the separation of the iodine-containing fractions, thyroxine, diiodotyrosine and inorganic iodide, have been utilized in these studies. Obviously, if exchange reactions can occur among these fractions during the isolation procedures or even under the conditions used for iodine metabolism, special caution is necessary in evaluating any results so obtained. The reported attempts to show that such exchanges can occur, although not very rigorous, were without success,<sup>4, 5</sup> nor was exchange observed by other workers in checks of their procedures.<sup>6, 7, 8</sup> Using radioiodine of 8-day half life, we have found exchanges between molecular iodine and diiodotyrosine and also between iodide ions and diiodotyrosine. These two reactions have been rather broadly investigated and some of the characteristics of each are briefly described in this preliminary note.

The exchange between iodine and diiodotyrosine was carried out in aqueous solution at 25° C. The amount of exchange occurring in a given time was determined by extracting the iodine with carbon tetrachloride and then measuring the radioactivity of the resulting two solutions. For this a small glass-jacketed Geiger counter tube<sup>9</sup> was used into which an aliquot of the solution was introduced. This procedure was proved satisfactory by an alternative method in which diiodotyrosine was isolated from the water layer and recrystallized to constant specific activity (counts/min./mg.) as determined by counting the solid with a mica window type counter tube. Although most of the work was concerned with the exchange from radio-diiodotyrosine to iodine, exchange in the opposite direction was also found.

In a given experiment the rate of reaction was not, as expected for simple exchange processes,<sup>10</sup>

<sup>1</sup> J. P. Leland and G. L. Foster, *Jour. Biol. Chem.*, 95: 165, 1932.

<sup>2</sup> A. B. Gutman, E. M. Benedict, B. Baxter and W. W. Palmer, *ibid.*, 97: 303, 1932.

<sup>3</sup> N. F. Blau, *ibid.*, 110: 351, 1935.

<sup>4</sup> P. Sue, *Compt. Rend.*, 212: 237, 1941.

<sup>5</sup> C. P. LeBlond and P. Sue, *Am. Jour. Physiol.*, 134: 549, 1941.

<sup>6</sup> I. Perlman, M. E. Morton and I. F. Chaikoff, *Jour. Biol. Chem.*, 139: 449, 1941.

<sup>7</sup> M. E. Morton and I. F. Chaikoff, *ibid.*, 147: 1, 1943.

<sup>8</sup> M. E. Morton, I. F. Chaikoff, W. O. Reinhardt and E. Anderson, *ibid.*, 147: 757, 1943.

<sup>9</sup> R. B. Barnes and D. J. Salley, *Ind. Eng. Chem. Analyt. Ed.*, 15: 4, 1943.

<sup>10</sup> H. A. C. McKay, *Jour. Am. Chem. Soc.*, 65: 702, 1943. Equation (2), p. 703.

independent of time, but it usually decreased slightly. Both the relative and absolute concentrations of the reactants affected the reaction rate over a range of radio-diiodotyrosine concentrations from  $1$  to  $10 \times 10^{-8}$  mols/cc and iodine to radio-diiodotyrosine ratios from 2 to 130. Thus, for a radio-diiodotyrosine concentration of about  $2 \times 10^{-8}$  mols/cc a change of iodine from 5 to 60 fold excess increased from 18 to 62 per cent. the exchange to completion in 15 minutes at a pH of 2. It was of interest to note that when the above exchange at the higher ratio was carried out in the dark, the observed exchange was only 27 per cent. Normally, the exchange rate was independent of pH in the range 0.8 to 3.0, but increased at higher pH values. As an example, when the radio-diiodotyrosine concentration was about  $1.6 \times 10^{-8}$  mols/cc and the iodine to diiodotyrosine ratio 5 to 1, the exchange to completion in five minutes was 8 per cent. at pH 2, but 72 per cent. at pH 5.

The exchange between potassium iodide and diiodotyrosine in aqueous solution was observed to go in either direction, although radioiodide and inactive diiodotyrosine were usually used as the initial reactants. To determine the per cent. exchange to completion, diiodotyrosine was first isolated from the reaction mixture and recrystallized to constant specific activity as determined by counting the solid itself; comparison was then made between the specific activity found and that calculated for complete theoretical exchange.

The iodide-diiodotyrosine exchange was extremely slow at 25° C. However, runs at increasing temperatures gave increasing exchange rates until at 90° C. exchange was at least 97 per cent. complete in three minutes. At 50° C., where much of the work was done, an exchange was observed of 9, 29 and 92 per cent. to completion in 5, 15 and 90 minutes, respectively. For these experiments, a diiodotyrosine concentration of  $2.2 \times 10^{-8}$  mols/cc, a diiodotyrosine to radioiodide equivalent ratio of 10 to 1 and a pH of about 5 were used. No induction periods were encountered at the higher temperatures, but at the lower temperatures such as 37° C., they were of uncertain length; even at 50° C. they were sometimes found. The rate appeared dependent on the relative and absolute concentrations of reactants over the concentration limits 2 to  $44 \times 10^{-7}$  mols/cc. The reaction was sensitive to pH, with the maximum exchange rate at pH 4 to 5.5 at all temperatures. At pH 2, and 50° C., the rate was only about 5 per cent. of the maximum. At pH 7.5, the reaction mixture was held at 37° C. for over two days without significant exchange in contrast to an exchange of 62 per cent. in only six hours at pH 4.3.

Certain compounds inhibited the iodide-diiodotyrosine exchange. The anti-thyroid drugs, 2-thiouracil and 2-mercaptopthiazoline<sup>11</sup> as well as the compounds 4-thiouracil and sodium thiosulfate stopped the reaction for a time dependent on the concentration of the reactants and the temperature. Thus at 50° C. with 2-thiouracil in 0.05 per cent. the concentration of diiodotyrosine, only about 2 per cent. of the normal exchange for one hour was found. On the other hand, at 37° C., the addition of as little molecular iodine as 1 per cent. of the total radioiodide (diiodotyrosine to radioiodide equivalent ratio of 10 to 1) decreased the time from five hours to one hour for 65 per cent. exchange to completion. These inhibition and acceleration effects might both be expected since first, the thio compounds react readily with iodine<sup>12</sup> and second, the diiodotyrosine exchange with iodine occurs much faster than with iodide.

In view of the literature concerning the deuterium exchange reactions of tyrosine<sup>13, 14</sup> as well as the lack of radioiodide exchange of certain aromatic iodine compounds,<sup>15, 16</sup> the exchange of compounds related to diiodotyrosine was tried. In 50 per cent. aqueous methanol solution at 50° C., exchange was found between iodine-radioiodide mixtures and 3,5-diido-p-eresol, 2,6-diiodophenol, 4,6-diiodophenol and 2,4,6-triiodophenol.

The mechanisms of the two exchange reactions do not appear to be simple. The reactions may be related and it is possible that iodine is an active agent in the iodide-diiodotyrosine exchange. Further, the exchange reactions perhaps may not occur directly but may depend on some intermediate step. The fact that the iodide-diiodotyrosine exchange was affected by inhibitors and accelerators may be associated with the variable induction period noted at the lower temperatures. Some difficulties were encountered in obtaining exact duplication of the data; this is probably associated with the above effects and with the need for more closely controlling concentrations and pH. However, the data obtained were in fairly good qualitative agreement.

The results do not indicate that exchange reactions necessarily occur *in vivo* among various iodine compounds. On the contrary, certain of our experiments suggest the unlikelihood of such a possibility.

<sup>11</sup> E. B. Astwood, *Jour. Pharm. and Exp. Therap.*, 78: 79, 1943; also private communication.

<sup>12</sup> E. B. Astwood, W. H. Miller and R. O. Roblin, Jr., unpublished.

<sup>13</sup> D. Rittenberg, A. S. Keston, R. Shoenheimer and G. L. Foster, *Jour. Biol. Chem.*, 125: 1, 1938.

<sup>14</sup> A. R. Moss and R. Shoenheimer, *ibid.*, 135: 414, 1940.

<sup>15</sup> F. Juliusberger, B. Topley and J. Weiss, *Jour. Chem. Soc.*, 1295, 1935.

<sup>16</sup> H. A. C. McKay, *Nature*, 139: 283, 1937.

However, we feel that this work does show the need to insure that results of metabolic studies are not distorted by exchange reactions occurring during subsequent *in vitro* procedures.

The l-diiodotyrosine used in these studies was either recrystallized Eastman Kodak Product or material synthesized here using either active or ordinary iodine. The radioiodine used was obtained in four lots from Columbia University and we wish to express our appreciation to the Cyclotron Staff for their cooperation.

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#### EFFECT OF HEXYL RESORCINOL ON DIFFUSION OF CHLORIDE AND SULFATE THROUGH SINTERED GLASS AND OTHER MEMBRANES

HEXYL resorcinol inhibits absorption of chloride in the ileum and promotes that of sulfate from a solution of sodium chloride-sodium sulfate, each component one-half isotonic with respect to blood.<sup>1</sup> The purpose of the experiments reported here was to determine what effect hexyl resorcinol has on the diffusion of chloride and sulfate through membranes *in vitro*.

Five membranes were used: sintered glass, mesenteric, egg, Cellophane and parchment paper. In studying the sintered glass membrane, the method described by Northrop and Anson<sup>2</sup> was used. The mesenteric membranes were obtained from live dogs and used immediately, the egg membranes were prepared by dissolving the shell of eggs in 10 per cent. HCl, removing the contents of the egg and washing the membranes until free from chloride, and the Cellophane was du Pont's No. 600. This membrane, as well as the parchment paper, was soaked for 20 hours in distilled water. Twenty cc of the chloride-sulfate solution were placed in a test-tube, the open end of which was covered by a membrane. The tube was inverted in 10 cc of water and the solution allowed to diffuse 20 to 40 hours at 25° C. Chloride was determined by the modified Volhard-Harvey titration as described by Peters and Van Slyke (1932, p. 829), and sulfate by the method given by Koek (1937, p. 199). The results are depicted graphically in Fig. 1. Hexyl resorcinol was without effect on the sintered glass membrane, but in all other cases except two (no effect on sulfate diffusion through parchment paper

<sup>1</sup> R. L. Driver, *Am. Jour. Phys.*, 135: 330, 1941.

<sup>2</sup> J. H. Northrop and M. L. Anson, *Jour. Gen. Phys.*, 12: 543, 1929.

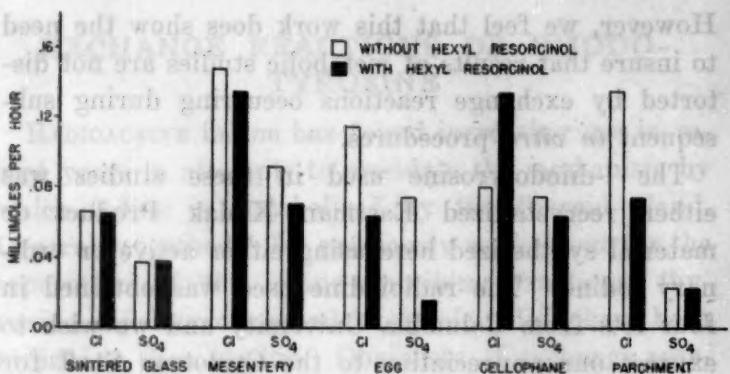


FIG. 1

and an increase in chloride diffusion through Cellophane) chloride and sulfate diffusion was inhibited by the presence of this phenolic substance.

## SCIENTIFIC APPARATUS AND LABORATORY METHODS

### ENDAMOEBA INVADENS AS AN AID IN THE STUDY OF ENDAMOEBA HISTOLYTICA

WHEN it is desired to make more than a perfunctory examination of living trophozoites of *Endamoeba histolytica*, a method must be employed to maintain the microscope slide at a warm temperature. In large classes this is not practical, and the methods used detract from the study of the organism. For this reason, some laboratories have found it advantageous to introduce the exercise by studying a reptilian amoeba, *Endamoeba invadens*, since this parasite is adapted to survival at a temperature range of 10–33° C. Moreover, in most essential features of morphology, life cycle and pathogenicity, this organism very closely resembles the human pathogen.

With the exception of a few minor differences, the morphology of the trophozoite stage is strikingly similar to that of *E. histolytica*. The cytoplasm is dense, the karyosomal granules of the nucleus are situated centrally, and the nuclear membrane is lined with a thin, evenly distributed layer of discrete chromatin granules.<sup>1</sup> The quadrinucleate cysts likewise are very comparable to those of *E. histolytica*, and their size, as well as the size of the trophozoites, is within the range of that of the human parasite.

The life cycle and pathogenicity of this reptilian amoeba also have been studied in detail.<sup>2, 3</sup> The processes of encystation, excystation and metacystic development resemble very closely those published for *E. histolytica*. This is true particularly for excystation, where even minute details are in agreement entirely with those reported by Dobell for the human

<sup>1</sup> H. L. Ratcliffe and Q. M. Geiman, SCIENCE, 79: 324, 1934.

<sup>2</sup> Q. M. Geiman and H. L. Ratcliffe, Parasitology, 28: 208, 1936.

<sup>3</sup> H. L. Ratcliffe and Q. M. Geiman, Arch. of Path., 25: 160, 1938.

It is possible that surface tension is involved in these studies. Hexyl resorcinol by virtue of its property to lower surface tension (decrease free energy) accumulates in the surface of water, and supposedly stops up the pores of the membrane keeping the ion from going through. If this interpretation of the data is accurate it is necessary that a revision be made in the general ideas of surface tension and passage through a dialytic membrane. A substance which lowers surface tension should not increase the passage of another substance through a membrane unless the two substances are miscible.

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amoeba.<sup>4</sup> The disease produced by *E. invadens* is comparable in its essential features to amoebiasis in man. However, in reptiles, irregularly outlined, undermining ulcers of the colon do not develop; liver involvement is more common in reptiles; and lesions of the stomach and upper part of the small intestine are peculiar to the reptilian disease.<sup>5</sup>

*Endamoeba invadens* can be cultivated easily at room temperature on a medium consisting of 0.3 per cent. gastric mucin in 0.5 per cent. aqueous "ground alum" salt, to which is added about 2 mg of sterile rice starch.<sup>3</sup> For the convenience of laboratories not equipped to maintain stock cultures, this organism now can be obtained from the General Biological Supply House, and by placing orders in advance, it is possible to receive the material for class use without the necessity of subculturing.

It is recommended that laboratory exercises on *Endamoeba histolytica* be introduced by a preliminary study of *Endamoeba invadens*, since this reptilian amoeba so closely resembles the human pathogen, yet can be observed for long periods without the inconvenience of warming the microscope slide.

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